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Docket No.: D-1215 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	
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Takaei Kitagawa	:	
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Serial No. 10/058,021	:	Group Art Unit: 2855
	:	
Filed: January 29, 2002	:	Examiner: Michael T. Cygan
	:	

For: LIQUID TRANSFER DEVICE, CONTROL METHOD OF LIQUID MIXING RATIO THEREOF AND LIQUID CHROMATOGRAPH WITH LIQUID TRANSFER DEVICE

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Attn: BOARD OF PATENT APPEALS AND INTERFERENCES

APPELLANT'S BRIEF (37 C.F.R. § 1.192)

This brief is in furtherance of the Notice of Appeal, filed in this case on August 30, 2004.

The fees required under § 1.17(f) and any required petition for extension of time for filing this brief and fees therefore, are dealt with in the accompanying TRANSMITTAL OF APPEAL BRIEF.

This brief is transmitted in triplicate.

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I. REAL PARTY IN INTEREST

The real party in interest in this appeal is SHIMADZU CORPORATION of 1, Nishinokyo-Kuwabaracho, Nakagyo-ku, Kyoto 604, JAPAN.

II. RELATED APPEALS AND INTERFERENCES

The Appellant knows of no other appeals or interferences that will directly affect, or be directly affected by, or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

Claims 1 and 4-12 remain pending. Claims 2 and 3 have been canceled. All currently pending claims have been finally rejected. In particular, claims 1 and 4-12 are rejected under 35 USC § 103 (a) as being unpatentable over O'Dougherty (US Patent No. 5,924,794) in view of Allington (US Patent No. 3,398,689). The Appellant appeals the final rejection of claims 1 and 4-12.

IV. STATUS OF AMENDMENTS

No Amendments have been filed since receiving the Final Action mailed June 10, 2004.

V. SUMMARY OF INVENTION

The described embodiments relate to methods and devices for obtaining an accurate mixing ratio of a liquid mixture. In one embodiment,[1] a plunger 1 is movable to draw independently supplied Liquid A and Liquid B through a mixing point 13 and into a pump chamber 3 which is connected through a check valve 7 to a mixer 19 that mixes the liquids. Plunger 1 is driven by a

[1] Application No. 10/058,021, paragraphs 26 to 30 and Fig. 1.

cam 11 connected to a motor 9. A detector 25 receives the mixed liquids from the mixer 19 and generates a detection signal that represents the components of the mixed liquids sensed by the detector. An operation portion 27 receives the detection signal and determines an actual mixing ratio of Liquid A and Liquid B transferred from pump chamber 3. Operation portion 27 includes mixing ratio error calculation portion 29 for calculating a mixing ratio error between the actual mixing ratio determined by operation portion 27 and a predetermined mixing ratio stored within the operation portion. Operation portion 27 stores the mixing ratio error in memory portion 31. Additionally, operation portion 27 includes a valve-switching-timing correction portion 33 for controlling a controlling portion 15 to correct the switching timing, based on the mixing ratio error stored in memory portion 31, of switch valves VA and VB that respectively control the flow of Liquid A and Liquid B through mixing point 13 and into pump chamber 3. Control portion 15 also controls motor 9 to operate plunger 1 based on commands from operation portion 27 and based on feedback of the actual position of plunger 1 received from position sensor 17. Thus, the described methods and devices separately control independent supply valves VA and VB, and associated pumping mechanisms, to control a ratio of Liquid A and Liquid B supplied to pump chamber 3. The supplied ratio of Liquid A and Liquid B in pump chamber 3 is adjusted by adjusting the respective supply valves to provide an accurate mixing ratio based on the mixing ratio error determined from the actual mixing ratio detected in the mixture at the outlet of mixer 19.

Therefore, the described embodiments control the operation of pumping mechanisms and supply valves associated with both Liquid A and Liquid B to adjust a supplied ratio of both liquids transferred from pump chamber 3 to mixer 19. The described embodiments account for mixing ratio errors associated with the supply system based on post-mixing measurements. Such supply system-related errors may include errors in a relative position of a pump, errors in the accuracy of systems driving the pump, influences of compression ratios in the liquid components, etc.[2] Thus, the described embodiments provide for the transfer of an accurate mixing ratio of at least two different liquids into pump chamber 3, and further to mixer 19.

In particular, claim 1 is directed to a method for obtaining an accurate mixing ratio of a liquid mixture in a liquid transfer device with a low pressure gradient function, which comprises:

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[2] *Id.* at paragraph 38, lines 1-4.

providing a pump chamber having a plunger to provide suction and discharge operations; mixing at least two different liquids at a predetermined mixing ratio by changing a switching timing of switch valves, said at least two different liquids being sucked into the pump chamber alternately by operation of the plunger and by switching the switch valves to thereby determine an actual mixing ratio of the at least two different liquids mixed together; calculating a mixing ratio error as a difference between said actual mixing ratio and said predetermined mixing ratio; storing said mixing ratio error in a memory; correcting the switching timing of the switch valves for the at least two different liquids based on said stored mixing ratio error in operating the plunger for a practical operation subsequently performed to thereby obtain the accurate mixing ratio of the at least two different liquids; and sequentially transferring said at least two different liquids as the practical operation by opening and closing the switch valves for the liquids, said switching timing of the switch valves being corrected for subsequent transfer of the at least two different liquids.

Claim 4 is directed to a liquid transfer device with a low pressure gradient function for transferring a mixture of at least two different liquids as a mobile phase for an analytical apparatus, which comprises: a plurality of switch valves connected to said at least two different liquids, respectively; a pump having a pump chamber with an outlet and an inlet connected to said switch valves, and a plunger slidably situated in the pump chamber for transferring the liquids to the pump chamber alternately through the switch valves to prepare a mixture thereof; a mixing ratio calculation portion for determining an actual mixing ratio of the mixture mixed at a predetermined mixing ratio by said pump; a mixing ratio error calculation portion for calculating a mixing ratio error as a difference between said actual mixing ratio calculated by said mixing ratio calculation portion and the predetermined mixing ratio electrically connected to said mixing ratio calculation portion; a memory portion for storing said mixing ratio error calculated by said mixing ratio error calculation portion electrically connected to said mixing ratio error calculation portion; and a valve-switching-timing correction portion for correcting a switching timing of the switch valves based on the mixing ratio error stored in said memory portion in operating the plunger for a practical operation subsequently performed to thereby obtain an accurate mixing ratio of the liquids in the practical operation, said valve-switching-timing correction portion being electrically connected to said mixing ratio error calculation portion, said memory portion, and said plurality of switch.

Claim 7 is directed to a liquid chromatograph, which comprises: a liquid transfer device with

a low pressure gradient function including a pump chamber having an inlet and an outlet, a plunger slidably situated in the pump chamber, and a plurality of switch valves connected to the inlet for changing liquids to be transferred at a predetermined timing for transferring the liquids sequentially as a mobile phase by an operation of the plunger to have a predetermined mixing ratio; a mixing ratio calculation portion for determining an actual mixing ratio of said mobile phase by the liquid transfer device actually operated based on the predetermined mixing ratio; a mixing ratio error calculation portion for calculating a mixing ratio error as a difference between said actual mixing ratio calculated by said mixing ratio calculation portion and the predetermined mixing ratio electrically connected to said mixing ratio calculation portion; a memory portion for storing said mixing ratio error calculated by said mixing ratio error calculation portion electrically connected to said mixing ratio error calculation portion; and a valve-switching-timing correction portion for correcting a switching timing of the switch valves based on the mixing ratio error stored in said memory portion in operating the plunger for a practical operation subsequently performed to thereby obtain an accurate mixing ratio of the liquids in the practical operation, said valve-switching-timing correction portion being electrically connected to said mixing ratio error calculation portion, said memory portion, and said plurality of switch valves.

VI. ISSUE

The only issue presented for consideration in this appeal is whether the Examiner erred in rejecting claims 1 and 4-12 under 35 USC § 103 (a) as being unpatentable over O'Dougherty (US Patent No. 5,924,794) in view of Allington (US Patent No. 3,398,689).

VII. GROUPING OF CLAIMS

The Appellant respectfully asserts that the claims are separately patentable, and thus, the claims do not stand or fall together.

VIII. ARGUMENT

The Examiner erred in rejecting claims 1 and 4-12 under 35 USC § 103 (a) as being unpatentable over O'Dougherty in view of Allington

The Applicant respectfully disagrees that the cited references disclose or suggest the recited method of obtaining an accurate mixing ratio and the recited liquid transfer and liquid chromatograph.

With regard to claim 1, the Applicants assert that no combination of O'Dougherty and Allington disclose or suggest the method of obtaining an accurate mixing ratio including providing a pump chamber with a plunger, "mixing at least two different liquids at a predetermined mixing ratio by changing a switching timing of switch valves, said at least two different liquids being sucked into the pump chamber alternately by operation of the plunger and by switching the switch valves to thereby determine an actual mixing ratio of the at least two different liquids mixed together," calculating a mixing ratio error associated with the actual mixing ratio and a predetermined mixing ratio, and correcting the switching timing of the switching valves based on the mixing ratio error to operate the plunger to obtain the accurate mixing ratio. The recited method transfers a supply of at least two different liquids with an actual mixing ratio to a pump chamber, where a ratio of the at least two liquids being sucked into the pump chamber is controlled by switching switch valves for the at least two liquids based on a mixing ratio error to achieve an accurate mixing ratio that is associated with a predetermined mixing ratio.

In contrast, O'Dougherty discloses a chemical blending system 10 that includes a pump 26 connected to a recirculation line 20 where *either concentrate adding valve 32* associated with a chemical supply line 30 *or diluent adding valve 156* associated with a diluent supply line 154 are controlled by a control subsystem 40 based on a concentration of blended chemicals in recirculation line 20 measured by conductivity sensors 34A and 34B or a titration analyzer 36.[3] O'Dougherty does not disclose or suggest controlling "a ratio of the at least two liquids being sucked into the pump chamber . . . by switching switch valves for the at least two liquids based on a mixing ratio error" as recited by claim 1. O'Dougherty teaches against controlling a ratio of at least two liquids in a pump chamber by switching the switch valves of the at least two liquids by disclosing a step-wise process of adding individual liquids to a recirculation line.

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[3] US Patent No. 5,924,794 to O'Dougherty, Abstract and Fig. 1.

In particular, O'Dougherty discloses first filling tank 12 with diluent from diluent inlet 14 by opening valve 60.[4] Then, when tank 12 is full, valve 60 is closed and pump 26 operates to circulate the diluent through recirculation line 20.[5] Then, system 10 opens concentrate adding valve 32 to add concentrated chemical to recirculation line 20 until the blended chemical has achieved a value greater than or equal to a Coarse Blend Point but less than or equal to a Fine Blend Setpoint, and then concentrate adding valve 32 is closed.[6] At this point, based on a measured concentration, system 10 calculates a time that concentrate adding valve 32 should be opened to achieve the Fine Blend Setpoint and opens concentrate adding valve 32 for the calculated amount of time.[7] System 10 then determeines if the measured concentration is within Upper and Lower Qualification Range Setpoints.[8] If the concentration is within the Range, then the process is complete.[9] If the concentration is below the Range, then concentrate adding valve 32 is opened for a calculated amount of time to achieve a concentration within the Range.[10] If the concentration is above the Range, then diluent adding valve 156 is opened for a calculated amount of time to achieve a concentration within the Range.[11] As such, O'Dougherty only controls one switch at a time and does not provide a switch-controlled supply of at least two different liquids to a pump chamber to obtain an accurate mixing ratio of the at least two different liquids based on a mixing ratio error. Thus, O'Dougherty does not disclose or suggest the method of obtaining an accurate mixing ratio as recited by claim 1.

The addition of Allington does not solve the deficiencies of O'Dougherty. Allington discloses an apparatus having a first pump 12 for drawing a first liquid from a first reservoir 13 and a second pump 15 for drawing a second liquid from a second reservoir 18. The fluids drawn by each pump 12, 15 are then combined to flow through pipe 18.[12] Allington thus discloses separate

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[4] *Id.* at col. 11, lines 20-22.

[5] *Id.* at col. 11, lines 24-26.

[6] *Id.* at col. 11, lines 43-48 and 58-63.

[7] *Id.* at col. 12, lines 8-10.

[8] *Id.* at col. 12, lines 14-20.

[9] *Id.* at col. 12, lines 24-31.

[10] *Id.* at col. 12, lines 46-50.

[11] *Id.* at col. 12, line 64 to col. 13, line 4.

[12] US Patent No. 3,398,689 to Allington, col. 4, lines 12-17.

pumps for separate liquids. As such, Allington does not disclose or suggest a switch-controlled supply of at least two different liquids to a pump chamber to obtain an accurate mixing ratio of the at least two different liquids based on a mixing ratio error. Thus, Allington does not disclose or suggest the method of obtaining an accurate mixing ratio as recited by claim 1. And, as such, there can be no combination of O'Dougherty and Allington that discloses or suggests the recited method of claim 1.

Additionally, the Examiner has failed to provide proper motivation to combine O'Dougherty and Allington. It is respectfully submitted that the Examiner has not yet set forth a *prima facie* case of obviousness. The PTO has the burden under §103 to establish a *prima facie* case of obviousness.[13] Both the case law of the Federal Circuit and the PTO itself have made clear that where a modification must be made to the prior art to reject or invalidate a claim under §103, there must be a showing of proper motivation to do so. The mere fact that a prior art reference could arguably be modified to meet the claim is insufficient to establish obviousness. The PTO can satisfy this burden only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references.[14] In order to establish obviousness, there must be a suggestion or motivation in the reference to do so.[15] In the Office Action, the Examiner merely states that the present invention is obvious in light of the cited references.[16] This is an insufficient showing of motivation.

With regard to claim 4, the Applicants assert that no combination of O'Dougherty and Allington disclose or suggest the liquid transfer device including a plurality of switch valves connected to at least two different liquids, "a pump having a pump chamber with an outlet and an inlet connected to said switch valves, and a plunger slidably situated in the pump chamber for transferring the liquids to the pump chamber alternately through the switch valves to prepare a

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[13] *In re Fine*, 5 U.S.P.Q.2nd 1596, 1598 (Fed. Cir. 1988).

[14] *Id.*

[15] *See also In re Gordon*, 221 U.S.P.Q. 1125, 1127 (Fed. Cir. 1984) (prior art could not be turned upside down without motivation to do so); *In re Rouffet*, 149 F.3d 1350 (Fed. Cir. 1998); *In re Dembiczak*, 175 F.3d 994 (Fed. Cir. 1999); *In re Lee*, 277 F.3d 1338 (Fed. Cir. 2002).

[16] Office Action mailed June 10, 2004, page 4.

mixture thereof," a mixing ratio calculation portion for determining an actual mixing ratio at a predetermined mixing ratio of the pump, a mixing ratio error portion for calculating a mixing ratio error, and a valve-switching-timing correction portion for correcting a switch timing of the plurality of switch valves to obtain the accurate mixing ratio for the liquids transferred to the pump chamber. As discussed in detail above, neither O'Dougherty nor Allington, nor any combination thereof, discloses or suggests a switch-controlled supply of at least two different liquids to a pump chamber to obtain an accurate mixing ratio of the at least two different liquids based on a mixing ratio error. Thus, the combination of O'Dougherty and Allington does not disclose or suggest the liquid transfer device as recited by claim 4.

With regard to claim 5, the Appellant submits that no combination of the cited references disclose or suggest all of the features of claim 5, and that the Examiner has failed to properly combine the cited references relating to the additional features of claim 5. O'Dougherty and Allington fail as 35 USC § 103(a) references for the reasons discussed above. Further, none of the references disclose or suggest a pump further including "a cam connected to the plunger, a motor connected to the cam for reciprocating the plunger, and a position sensor connected to the motor for detecting a position of the plunger through the motor." This claim does not stand or fall with any other claim at least for these reasons.

With regard to claim 6, the Appellant submits that no combination of the cited references disclose or suggest all of the features of claim 6, and that the Examiner has failed to properly combine the cited references relating to the additional features of claim 6. This claim does not stand or fall with any other claim for at least this reason.

With regard to claim 7, the Applicants assert that no combination of O'Dougherty and Allington disclose or suggest the liquid chromatograph including a liquid transfer device having "a pump chamber having an inlet and an outlet, a plunger slidably situated in the pump chamber, and a plurality of switch valves connected to the inlet for changing liquids to be transferred at a predetermined timing for transferring the liquids sequentially as a mobile phase by an operation of the plunger to have a predetermined mixing ratio," a mixing ratio calculation portion for determining an actual mixing ratio of the mobile phase, a mixing ratio error calculation portion for calculating a mixing ratio error, a memory portion, and a valve-switching-timing correction portion for correcting a switching timing of the switching valves to obtain an accurate mixing ratio of the

liquids in the pump chamber. As discussed in detail above, neither O'Dougherty nor Allington, nor any combination thereof, discloses or suggests a switch-controlled supply of at least two different liquids to a pump chamber to obtain an accurate mixing ratio of the at least two different liquids based on a mixing ratio error. Thus, the combination of O'Dougherty and Allington does not disclose or suggest the liquid transfer device as recited by claim 7.

With regard to claim 8, the Appellant submits that no combination of the cited references disclose or suggest all of the features of claim 8, and that the Examiner has failed to properly combine the cited references relating to the additional features of claim 8. This claim does not stand or fall with any other claim for at least this reason.

With regard to claim 9, the Appellant submits that no combination of the cited references disclose or suggest all of the features of claim 9, and that the Examiner has failed to properly combine the cited references relating to the additional features of claim 9. This claim does not stand or fall with any other claim for at least this reason.

With regard to claim 10, the Appellant submits that no combination of the cited references disclose or suggest all of the features of claim 10, and that the Examiner has failed to properly combine the cited references relating to the additional features of claim 10. In particular, no combination of the cited references discloses or suggests that "the switching timing of the switch valves is corrected in every gradient cycle by using the mixing ratio error calculated and stored in the memory." This claim does not stand or fall with any other claim for at least this reason.

With regard to claim 11, the Appellant submits that no combination of the cited references disclose or suggest all of the features of claim 11, and that the Examiner has failed to properly combine the cited references relating to the additional features of claim 11. In particular, no combination of the cited references discloses or suggests that "the switching timing of the switch valves is corrected in every gradient cycle by using the mixing ratio error calculated and stored in the memory." This claim does not stand or fall with any other claim for at least this reason.

With regard to claim 12, the Appellant submits that no combination of the cited references disclose or suggest all of the features of claim 12, and that the Examiner has failed to properly combine the cited references relating to the additional features of claim 12. In particular, no combination of the cited references discloses or suggests that "the switching timing of the switch

valves is corrected in every gradient cycle by using the mixing ratio error calculated and stored in the memory." This claim does not stand or fall with any other claim for at least this reason.

IX. CONCLUSION

For the extensive reasons discussed above, Appellant respectfully submits that the rejection of claims 1 and 4-12 under 35 USC § 103(a) is improper and should not be sustained. Therefore, Appellant respectfully requests a reversal of the Final Rejection by the Examiner.

If for any reason this Appeal Brief is found to be incomplete, or if at any time it appears that a telephone conference with counsel would help advance prosecution, please telephone the undersigned, Applicant's attorney of record.

Respectfully submitted,

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IX. APPENDIX OF CLAIMS INVOLVED IN THE APPEAL

1. A method for obtaining an accurate mixing ratio of a liquid mixture in a liquid transfer device with a low pressure gradient function, comprising:

providing a pump chamber having a plunger to provide suction and discharge operations;

mixing at least two different liquids at a predetermined mixing ratio by changing a switching timing of switch valves, said at least two different liquids being sucked into the pump chamber alternately by operation of the plunger and by switching the switch valves to thereby determine an actual mixing ratio of the at least two different liquids mixed together;

calculating a mixing ratio error as a difference between said actual mixing ratio and said predetermined mixing ratio;

storing said mixing ratio error in a memory;

correcting the switching timing of the switch valves for the at least two different liquids based on said stored mixing ratio error in operating the plunger for a practical operation subsequently performed to thereby obtain the accurate mixing ratio of the at least two different liquids; and

sequentially transferring said at least two different liquids as the practical operation by opening and closing the switch valves for the liquids, said switching timing of the switch valves being corrected for subsequent transfer of the at least two different liquids.

4. A liquid transfer device with a low pressure gradient function for transferring a mixture of at least two different liquids as a mobile phase for an analytical apparatus, comprising:

a plurality of switch valves connected to said at least two different liquids, respectively;

a pump having a pump chamber with an outlet and an inlet connected to said switch valves, and a plunger slidably situated in the pump chamber for transferring the liquids to the pump chamber alternately through the switch valves to prepare a mixture thereof;

a mixing ratio calculation portion for determining an actual mixing ratio of the mixture mixed at a predetermined mixing ratio by said pump;

a mixing ratio error calculation portion for calculating a mixing ratio error as a difference between said actual mixing ratio calculated by said mixing ratio calculation portion and the predetermined mixing ratio electrically connected to said mixing ratio calculation portion;

a memory portion for storing said mixing ratio error calculated by said mixing ratio error calculation portion electrically connected to said mixing ratio error calculation portion; and

a valve-switching-timing correction portion for correcting a switching timing of the switch valves based on the mixing ratio error stored in said memory portion in operating the plunger for a practical operation subsequently performed to thereby obtain an accurate mixing ratio of the liquids in the practical operation, said valve-switching-timing correction portion being electrically connected to said mixing ratio error calculation portion, said memory portion, and said plurality of switch.

5. A liquid transfer device according to claim 4, wherein said pump further includes a cam connected to the plunger, a motor connected to the cam for reciprocating the plunger, and a position sensor connected to the motor for detecting a position of the plunger through the motor.

6. A liquid transfer device according to claim 5, further comprising a mixer for mixing the mobile phase connected to the outlet of the pump, an injector portion connected to the mixer for injecting a sample into the mobile phase, a column portion for separating the sample connected to the injector portion, and a detector for detecting the sample connected to the column portion.

7. A liquid chromatograph comprises:

a liquid transfer device with a low pressure gradient function including a pump chamber having an inlet and an outlet, a plunger slidably situated in the pump chamber, and a plurality of switch valves connected to the inlet for changing liquids to be transferred at a predetermined timing

for transferring the liquids sequentially as a mobile phase by an operation of the plunger to have a predetermined mixing ratio;

a mixing ratio calculation portion for determining an actual mixing ratio of said mobile phase by the liquid transfer device actually operated based on the predetermined mixing ratio;

a mixing ratio error calculation portion for calculating a mixing ratio error as a difference between said actual mixing ratio calculated by said mixing ratio calculation portion and the predetermined mixing ratio electrically connected to said mixing ratio calculation portion;

a memory portion for storing said mixing ratio error calculated by said mixing ratio error calculation portion electrically connected to said mixing ratio error calculation portion; and

a valve-switching-timing correction portion for correcting a switching timing of the switch valves based on the mixing ratio error stored in said memory portion in operating the plunger for a practical operation subsequently performed to thereby obtain an accurate mixing ratio of the liquids in the practical operation, said valve-switching-timing correction portion being electrically connected to said mixing ratio error calculation portion, said memory portion, and said plurality of switch valves.

8. A liquid chromatograph according to claim 7, further comprising a detector for obtaining information of the actual mixing ratio of the mobile phase, said mixing ratio calculation portion calculating the actual mixing ratio based on a signal from said detector.

9. A liquid chromatograph according to claim 8, further comprising a mixer for mixing the mobile phase connected to the liquid transfer device, an injector portion connected to the mixer for injecting a sample into the mobile phase, and a column portion for separating the sample connected to the injector portion, said detector being connected to the column portion.

10. A method according to claim 1, wherein in a step of subsequently transferring the at least two different liquids as the practical operation, the switching timing of the switch valves is corrected in every gradient cycle by using the mixing ratio error calculated and stored in the

memory.

11. A liquid transfer device according to claim 4, wherein in the valve-switching-timing correction potion, the switching timing of the switch valves is corrected in every gradient cycle by using the mixing ratio error calculated at the mixing ratio error calculation portion and stored in the memory portion.

12. A liquid chromatograph according to claim 7, wherein in the valve-switching-timing correction potion, the switching timing of the switch valves is corrected in every gradient cycle by using the mixing ratio error calculated at the mixing ratio error calculation portion and stored in the memory portion.